

Biogeochemical impact of long-range transported dust over northern South China Sea

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Abstract

Transpacific transport and impact of Asian dust aerosols have been well documented (e.g., results from ACE-Asia and regional follow-on campaigns), but little is known about dust invasion to the South China Sea (SCS). On 19-21 March 2010, a fierce Asian dust storm affected large areas from the Gobi deserts to the West Pacific, including Taiwan and Hong Kong. As a pilot study of the 7-SEAS (Seven South East Asian Studies) in the northern SCS, detailed characteristics of long-range transported dust aerosols were first observed by a comprehensive set of ground-based instruments deployed at the Dongsha islands (20°42'52" N, 116°43'51" E). Aerosol measurements such as particle mass concentrations, size distribution, optical properties, hygroscopicity, and vertical profiles help illustrate the evolution of this dust outbreak. Our results indicate that these dust particles were mixed with anthropogenic and marine aerosols, and transported near the surface. Satellite assessment of biogeochemical impact of dust deposition into open oceans is hindered by our current inability in retrieving areal dust properties and ocean colors over an extensive period of time, particularly under the influence of cloudy conditions. In this paper, we analyze the changes of retrieved Chlorophyll-a (Chl-a) concentration over the northern SCS, considered as oligotrophic waters in the spring, from long-term SeaWiFS measurements since 1997. Over the past decade, six long-range transported dust events are identified based on spatiotemporal evolutions of PM₁₀ measurements from regional monitoring stations, with the aid of trajectory analysis. Multi-year composites of Chl-a imagery for dust event and non-dust background during March-April are applied to overcome insufficient retrievals of Chl-a due to cloudy environment. Due to anthropogenic modification within a shallow boundary layer off the densely populated and industrial southeast coast of China, the iron ion activation of deliquescent dust particles enhances the efficiency of fertilization for biological productivity. Compared to the West Pacific, the marine ecosystem in the northern SCS is much more susceptible to the biogeochemical impact of long-range transported Asian dust.